

CLAIMS

I claim:

1. A blood purification system for the effective sterilization of microorganisms, the system comprising at least one light source connected by at least one optical connection positioned to provide a focused, controllable light output to a blood purifier, and a control mechanism, thereby producing at least one UV dose zone for the effective sterilization of microorganisms in a blood.
2. The blood purification system according to claim 1, wherein the light source is a light pump including at least one lamp, at least one optic, a housing, and a power supply.
3. The blood purification system according to claim 1, wherein the light source is at least one lamp.
4. The blood purification system according to claim 3, wherein the lamp is a UV lamp.
5. The blood purification system according to claim 4, wherein the UV lamp is a high-intensity lamp.
6. The blood purification system according to claim 4, wherein the UV lamp is a spectral calibration lamp.
7. The blood purification system according to claim 4, wherein the UV lamp is an electrodeless lamp.
8. The blood purification system according to claim 4, wherein the UV lamp is a mercury halide lamp.

- 1 9. The blood purification system according to claim 4, wherein the UV lamp emits
2 light in the UVV and UVC wavelengths.
- 3 10. The blood purification system according to claim 4, wherein the light source
4 includes at least one light source optical component positioned to provide a
5 focused, controllable light output to a blood purifier.
- 6 11. The blood purification system according to claim 10, wherein the light source
7 optical component is UV transmissive.
- 8 12. The blood purification system according to claim 10, wherein the light source
9 optical component is UV reflective.
- 10 13. The blood purification system according to claim 10, wherein the at least one light
11 source optical component is selected from the group consisting of reflectors,
12 shutters, lenses, splitters, focalizers, mirrors, rigid and flexible light guides,
13 homogenizer, mixing rods, manifolds and other couplers, filters, gratings,
14 diffractors, gradient lenses, color wheels, off-axis reflectors, cascading reflectors,
15 splitting reflectors, and combinations thereof.
- 16 14. The blood purification system according to claim 1, wherein the at least one
17 optical connection is a fiber optic transmission line.
- 18 15. The blood purification system according to claim 14, wherein the fiber optic
19 transmission line is removably connectable to the light source and the blood
20 purifier.
- 21 16. The blood purification system according to claim 1, wherein the fiber optic
22 transmission line is selected from the group of fiber optic transmission lines

1 including acrylic lines, glass lines, liquid core lines, quartz lines, hollow core
2 lines, core-sheath lines, dielectric coaxial lines, and combination thereof.

3 17. The blood purification system according to claim 1, wherein the blood purifier
4 includes a dose zone and a housing.

5 18. The blood purification system according to claim 17, wherein the housing is UV
6 reflective.

7 19. The blood purification system according to claim 17, wherein the dose zone
8 includes a portal for removable connection to a fiber optic transmission line.

9 20. The blood purification system according to claim 19, further including at least one
10 portal optical component positioned between the portal opening and the interior of
11 the blood purifier.

12 21. The blood purification system according to claim 20, wherein the at least one
13 portal optical component is UV transmissive.

14 22. The blood purification system according to claim 20, wherein the at least one
15 portal optical component is UV reflective.

16 23. The blood purification system according to claim 20, wherein the at least one
17 portal optical component is selected from the group consisting of reflectors,
18 shutters, lenses, splitters, focalizers, mirrors, rigid and flexible light guides,
19 homogenizer, mixing rods, manifolds and other couplers, filters, gratings,
20 diffractors, gradient lenses, color wheels, off-axis reflectors, cascading reflectors,
21 splitting reflectors, and combinations thereof.

22 24. The blood purification system according to claim 1, wherein the blood purifier
23 uses enhanced two-dimensional design to improve the blood purification.

- 1 25. The blood purification system according to claim 1, wherein the blood purifier
2 uses enhanced three-dimensional design to improve the blood purification.
- 3 26. The blood purification system according to claim 17, wherein the dose zone
4 includes a delivery device.
- 5 27. The blood purification system according to claim 26, wherein the delivery device
6 includes at least one light emitter selected from the group consisting of side-
7 emitting fiber optic transmission lines, end-emitting fiber optic transmission line,
8 and combinations thereof.
- 9 28. The blood purification system according to claim 26, wherein the delivery device
10 is a vertical riser configuration (VRC) in which the blood is moved at a
11 predetermined rate toward the UV light output, thereby producing an increasing
12 UV dose within the blood as it approaches the light output.
- 13 29. The blood purification system according to claim 28, wherein the vertical riser
14 configuration system is scalable to applications.
- 15 30. The blood purification system according to claim 26, wherein the delivery device
16 is a planar configuration in which the blood is moving at a predetermined rate
17 perpendicular to the UV light output, thereby producing a constant UV dose
18 within the blood as it moves through the delivery device.
- 19 31. The blood purification system according to claim 28, wherein the blood purifier is
20 manufactured from a material selected from the group consisting of acrylic,
21 plastic, quartz, glass, and combinations thereof.
- 22 32. The blood purification system according to claim 28, wherein the blood purifier is
23 disposable.

- 1 33. The blood purification system according to claim 1, wherein at least one interior
2 surface of the blood purifier is a UV reflective surface.
- 3 34. The blood purification system according to claim 33, wherein the at least one UV
4 reflective surface is selected from the group consisting of aluminum, stainless
5 steel, and combinations thereof.
- 6 35. The blood purification system according to claim 1, wherein the interior of the
7 blood purifier includes at least one interior optical component that is attached to
8 the interior surfaces.
- 9 36. The blood purification system according to claim 35, wherein the at least one
10 interior optical component is UV transmissive.
- 11 37. The blood purification system according to claim 35, wherein the at least one
12 interior optical component is UV reflective.
- 13 38. The blood purification system according to claim 35, wherein the at least one
14 interior optical component is selected from the group consisting of reflectors,
15 shutters, lenses, splitters, focalizers, mirrors, rigid and flexible light guides,
16 homogenizer, mixing rods, manifolds and other couplers, filters, gratings,
17 diffractors, gradient lenses, color wheels, off-axis reflectors, cascading reflectors,
18 splitting reflectors, and combinations thereof.
- 19 39. A blood purifier for the effective sterilization of microorganisms in a blood, the
20 blood purifier including a dose zone and housing, thereby producing at least one
21 dose region for the effective sterilization of microorganisms in a blood.
- 22 40. The blood purifier system according to claim 39, wherein the housing is UV
23 reflective.

- 1 41. The blood purifier according to claim 39, wherein the housing includes a portal
2 for removable connection to a fiber optic transmission line.
- 3 42. The blood purifier according to claim 39, further including at least one portal
4 optical component positioned between the portal and the interior of the blood
5 purifier.
- 6 43. The blood purifier according to claim 42, wherein the at least one portal optical
7 component is UV transmissive.
- 8 44. The blood purifier according to claim 42, wherein the at least one portal optical
9 component is UV reflective.
- 10 45. The blood purifier according to claim 42, wherein the at least one portal optical
11 component is selected from the group consisting of reflectors, shutters, lenses,
12 splitters, focalizers, mirrors, rigid and flexible light guides, homogenizer, mixing
13 rods, manifolds and other couplers, filters, gratings, diffractors, gradient lenses,
14 color wheels, off-axis reflectors, cascading reflectors, splitting reflectors, and
15 combinations thereof.
- 16 46. The blood purifier according to claim 39, wherein the blood purifier uses
17 enhanced two-dimensional design to improve the blood purification.
- 18 47. The blood purifier according to claim 39, wherein the blood purifier uses
19 enhanced three-dimensional design to improve the blood purification.
- 20 48. The blood purifier according to claim 39, wherein the dose zone further includes a
21 delivery device.
- 22 49. The blood purifier according to claim 48, wherein the delivery device includes at
23 least one light emitter selected from the group consisting of side-emitting fiber

1 optic transmission lines, end-emitting fiber optic transmission line, and
2 combinations thereof.

3 50. The blood purification system according to claim 48, wherein the delivery device
4 is a vertical riser configuration (VRC) in which the blood is moved at a
5 predetermined rate toward the UV light output, thereby producing an increasing
6 UV dose within the blood as it approaches the light output.

7 51. The blood purification system according to claim 50, wherein the vertical riser
8 configuration system is scalable to applications.

9 52. The blood purification system according to claim 48, wherein the delivery device
10 is a planar configuration in which the blood is moving at a predetermined rate
11 perpendicular to the UV light output, thereby producing a constant UV dose
12 within the blood as it moves through the delivery device.

13 53. The blood purification system according to claim 50, wherein the blood purifier is
14 manufactured from a material selected from the group consisting of acrylic,
15 plastic, quartz, glass, and combinations thereof.

16 54. The blood purification system according to claim 50, wherein the blood purifier is
17 disposable.

18 55. The blood purification system according to claim 39, wherein at least one interior
19 surface of the blood purifier is a UV reflective surface.

20 56. The blood purification system according to claim 55, wherein the at least one UV
21 reflective surface is selected from the group consisting of aluminum, stainless
22 steel, and combinations thereof.

1 57. The blood purification system according to claim 39, wherein the interior of the
2 blood purifier includes at least one interior optical component that is attached to
3 the interior surfaces.

4 58. The blood purification system according to claim 58, wherein the at least one
5 interior optical component is UV transmissive.

6 59. The blood purification system according to claim 58, wherein the at least one
7 interior optical component is UV reflective.

8 60. The blood purification system according to claim 58, wherein the at least one
9 interior optical component is selected from the group consisting of reflectors,
10 shutters, lenses, splitters, focalizers, mirrors, rigid and flexible light guides,
11 homogenizer, mixing rods, manifolds and other couplers, filters, gratings,
12 diffractors, gradient lenses, color wheels, off-axis reflectors, cascading reflectors,
13 splitting reflectors, and combinations thereof.

14 61. A method for the effective sterilization of microorganisms in blood, comprising
15 the steps of: providing at least one UV light source connected by at least one
16 optical connection positioned to provide a focused, controllable light output to a
17 blood purifier, and a control mechanism, thereby producing at least one UV dose
18 zone for the effective sterilization of microorganisms in a blood; activating the
19 UV light source, passing the blood through the blood purifier, thereby providing
20 sterilized blood.